REMARKS

Claims 1 and 5-7 are pending in the present application. Claims 5 and 6 are withdrawn from consideration. This response does not amend, cancel, or add any claims. Accordingly, claims 1 and 7 are currently under consideration.

Rejections under 35 USC § 103

Claims 1 and 7 are rejected under 35 USC § 103(a) as allegedly being unpatentable over Huang et al. (US Pat. 6,693,352) in view of Shimada et al. (US Pat. 4,289,822).

The Examiner alleges that Huang et al. expressly or inherently discloses, in Figure 7 and related text, a device having all the features recited in Claim 1 except that the metal of the metal oxide layer in Huang et al. does not include a metal from the list recited in Claim 1. The Examiner further alleges that it would have been obvious to incorporate cerium oxide disclosed in Shimada et al. into the device disclosed in Huang et al. to provide the invention of Claim 1. (Office Action, §3)

A *prima facie* case of obviousness requires "some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings." MPEP §2143. Applicants respectfully submit that, contrary to the Examiner's assertion, one of ordinary skill in the art would have no motivation to modify the device disclosed in Huang et al. in the manner suggested by the Examiner, because one of ordinary skill in the art would not conclude that there would be any reason to do so.

Huang et al discloses in Figure 7 and related text a III-V semiconductor light emitting diode comprising, in order, a substrate 30, an AlGaInN buffer layer 31, an n+ AlGaInN cladding layer, an AlGaInN active structure 33, a p AlGaInN cladding layer 34, a p+ AlGaInN layer 35, a thin metal layer 36A, a transparent conducting oxide layer 37A, and a metal contact pad 38A. (col. 4, lines 32 -55). A portion of metal layer 36A is removed so that transparent conducting layer 37A contacts p+ AlGaInN layer 35 under contact pad 38A. (col. 10, lines 46-48). Transparent

conducting oxide layer 37A includes at least one of indium-tin-oxide, indium oxide, tin-oxide, and zinc oxide. (col. 5, lines 30-32).

One of ordinary skill in the art would recognize that the device of Huang et al. emits light when sufficiently forward biased, i.e., when the p-type layers are at a voltage sufficiently more positive than the n-type layers. According to Huang et al., the purpose of transparent conducting metal oxide layer 37A is to enhance light emission by spreading current laterally along the semiconductor layers while maintaining high optical transparency so that more of the active structure is utilized for light emission. (col. 1, lines 31-33; col. 2, lines 30-39 and 51-54). In addition, in the structure illustrated in Figure 7, a portion of metal layer 36A is removed so that transparent conduction layer 36A forms a blocking Shottky barrier contact to p+ AlGaInN layer 35 that reduces current injection into the active region directly under contact pad 38A and increases current injection density into the rest of the active region. (col. 10, lines 45-55).

Shimada et al. discloses in Figure 6 and related text cited by the Examiner a photosensor comprising, in order, a faceplate 31, a light-transmitting conductive layer 32, an n-type oxide layer 39, and an amorphous photoconductive layer 33 of $[Si_{1-x}C_x]_{1-y}[H]_y$. Shimada discloses that light-transmitting conductive layer 32 can employ tin oxide, indium oxide, titanium oxide or the like. (col. 6, lines 4-7), and that n-type oxide layer 39 can be cerium oxide, tungsten oxide, niobium oxide, germanium oxide, and molybdenum oxide. (col. 6, lines 37-40).

Shimada et al. discloses operating the photosensors disclosed therein as reverse-biased photodiodes. (e.g., col. 6, lines 17-21; col. 12, lines 57-58) According to Shimada et al., the purpose of n-type oxide layer 39 is "to form a rectifying contact between the transparent conductive film 32 and the photoconductive layer 33." (col. 6, lines 9-11, emphasis added) Shimada et al. explains that "[b]y interposing a thin n-type oxide layer between the photoconductive layer 33 and the transparent conductive film 32, it is possible to suppress the injection of positive holes from the transparent conductive film 32 into the photoconductive layer 33." (col. 6, lines 11-15, emphasis added). Shimada discloses that cerium oxide exhibits favorable characteristics for this use. (col. 6, lines 38-41).

The Examiner alleges that it would have been obvious to a person of ordinary skill in the art to incorporate cerium oxide disclosed in Shimada et al. into the device disclosed in Huang et al. "so that the electrical and optical characteristics can be improved in Huang et al.'s electrode." (Office Action, §3) However, the Examiner does not identify any particular electrical and optical characteristics in the device of Huang et al. that would be improved by this modification. Applicants respectfully submit that one of ordinary skill in the art would be similarly unable to identify any particular advantage to such a modification.

As noted above, in Shimada et al. the purpose of n-type oxide layer 39 is to form a rectifying layer in contact with $[Si_{1-x}C_x]_{1-y}[H]_y$ layer 33 that suppresses the injection of holes from transparent conductive film 32 into $[Si_{1-x}C_x]_{1-y}[H]_y$ layer 33. Shimada et al. discloses that cerium oxide has favorable characteristics for this use, i.e., forming a rectifying contact to a $[Si_{1-x}C_x]_{1-y}[H]_y$ layer in a photosensor. Shimada et al. does not disclose that cerium oxide has favorable characteristics for any other use.

The device of Huang et al. does not incorporate a $[Si_{1-x}C_x]_{1-y}[H]_y$ layer. Moreover, in operation the device of Huang et al. is forward biased and requires injection of holes from transparent conducting oxide layer 37A through thin metal layer 36A into p-type AlGaInN layer 35. Consequently, the only purpose for and advantage to using an n-type cerium oxide layer disclosed by Shimada et al. is irrelevant to the device disclosed by Huang et al.

Also as noted above, a primary purpose of transparent conducting metal oxide layer 37A in the device of Huang et al. is to spread current laterally in the device. Nothing in Shimada et al. suggests that cerium oxide advantageously promotes such current spreading. To the contrary, the device disclosed by Shimada et al. includes a separate transmitting conductive layer 32 of indium oxide, for example, in addition to n-type oxide layer 39. This reinforces the teaching in Huang et al. of indium oxide as a transparent conducting metal oxide layer, and teaches against substitution of cerium oxide for indium oxide in such a role.

Another purpose for transparent conducting layer 37A in Huang et al., cited above, is to form a Shottky barrier contact to p+ AlGaInN layer 35 directly under contact pad 38A that enhances lateral current spreading while maintaining high optical transparency. Nothing in Shimada et al. indicates that a cerium oxide layer would advantageously perform this role. Shimada et al. does not even disclose the use of AlGaInN materials, much less the performance of a cerium oxide/AlGaInN contact.

Hence, one of ordinary skill in the art would not identify any reason to make the combination suggested by the Examiner. Moreover, as demonstrated above, the devices disclosed in Huang et al. and Shimada et al. differ significantly in structure, materials (AlGaInN v. $[Si_{1-x}C_x]_{1-y}[H]_y$), bias during operation (forward v. reverse), and function (light emission v. light detection). There does not appear to be any reason for one of ordinary skill in the art to look to the disclosure of Shimada et al. for materials to substitute into the very different device disclosed in Huang et al. For all of these reasons, one of ordinary skill in the art would have no motivation to make the combinations suggested by the Examiner to allegedly provide the invention of Claim 1.

Claim 7 is dependent on Claim 1 and thus patentable over the combination of Huang et al. and Shimada et al. for at least the reasons that Claim 1 is patentable over this combination. Hence, Applicants respectfully request that the Examiner withdraw the rejections under 35 USC § 103.

CONCLUSION

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue. If it is determined that a telephone conference would expedite the prosecution of this application, the Examiner is invited to telephone the undersigned at the number given below.

In the event the U.S. Patent and Trademark office determines that an extension and/or other relief is required, applicant petitions for any required relief including extensions of time and authorizes the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to Deposit Account No. 03-1952 referencing docket no. **245402008300**. However, the Commissioner is not authorized to charge the cost of the issue fee to the Deposit Account.

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Respectfully submitted,

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